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(54) Abstract Title
Preventing accidental calling from a communication terminal

(57) A communications terminal (30) comprising: a plurality of keys (9) for input to the terminal, means (36, 38) for generating a plurality of measurements of different characteristics of one or more interactions with one or more of said keys 52; means (35) for comparing 56 the plurality of measurements for at least a first of said characteristics; and means (35) for controlling the establishment of a call on the basis of the results of said comparison. The different characteristics which may be measured include galvanic skin response, capacitive proximity detection or pressure sensing. Furthermore a call may only be allowed to be established if the measurements for at least one characteristic are determined to be similar to one another.

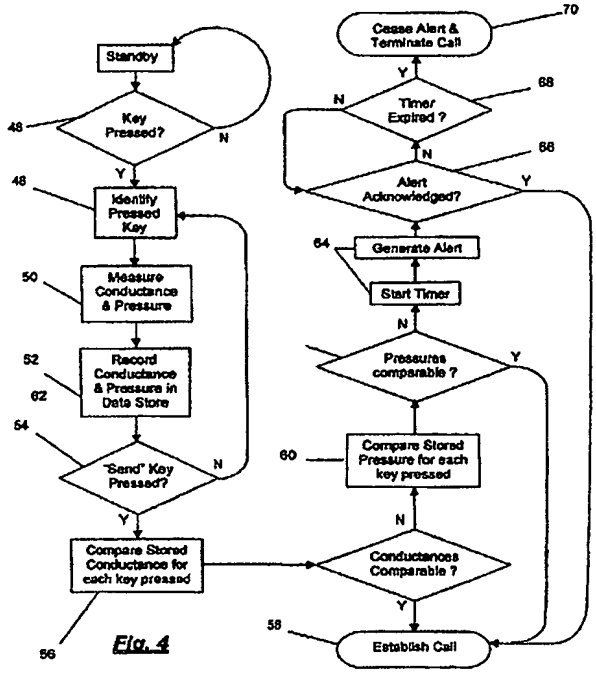

Fig. 4

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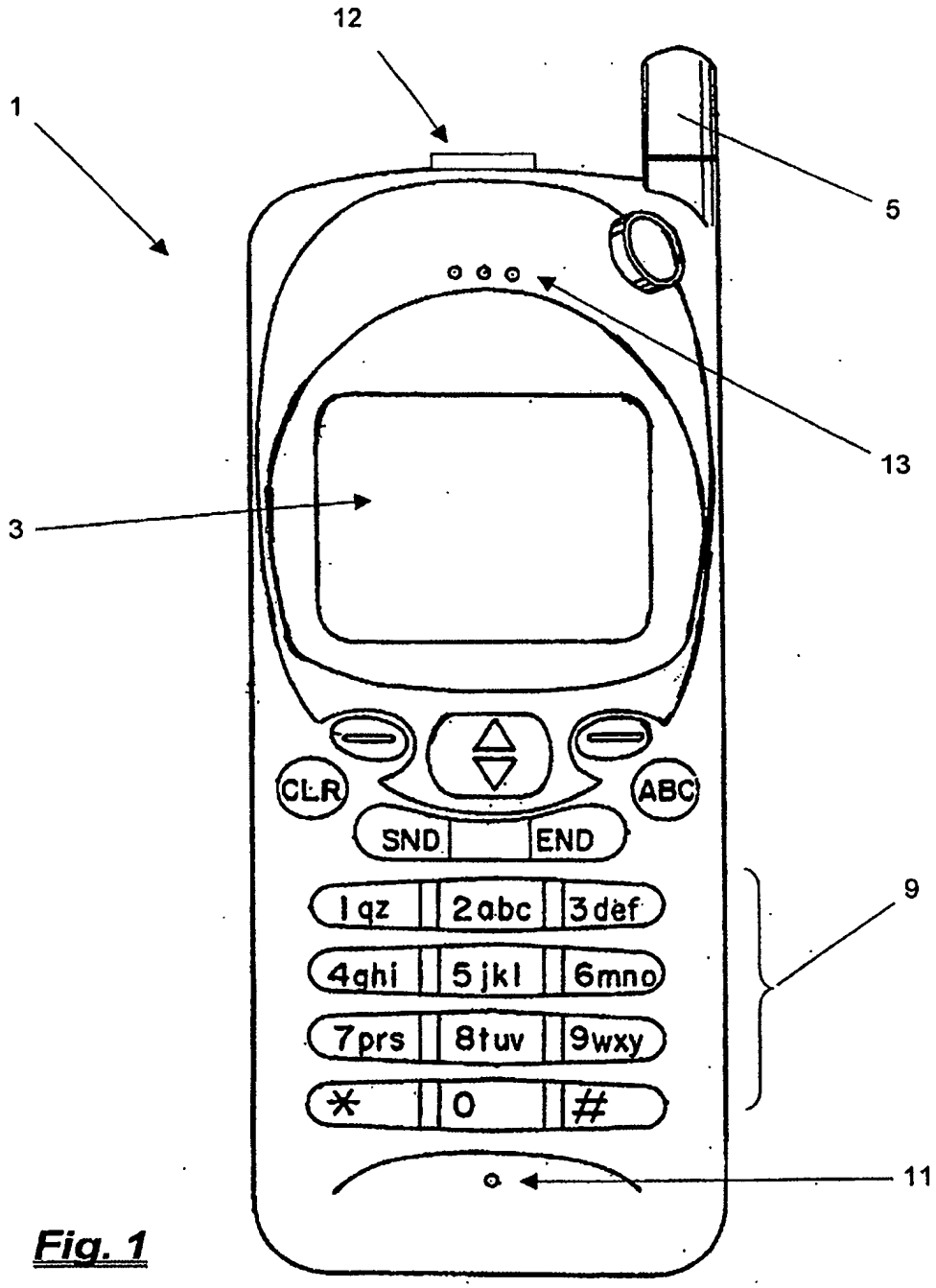

12
1
5
13
3
CLR
ABC
SND
END
1 qz
2 abc
3 def
4 ghi
5 jkl
6 mno
7 prs
8 tuv
9 wxy
*
0
#
9
11

Fig. 1

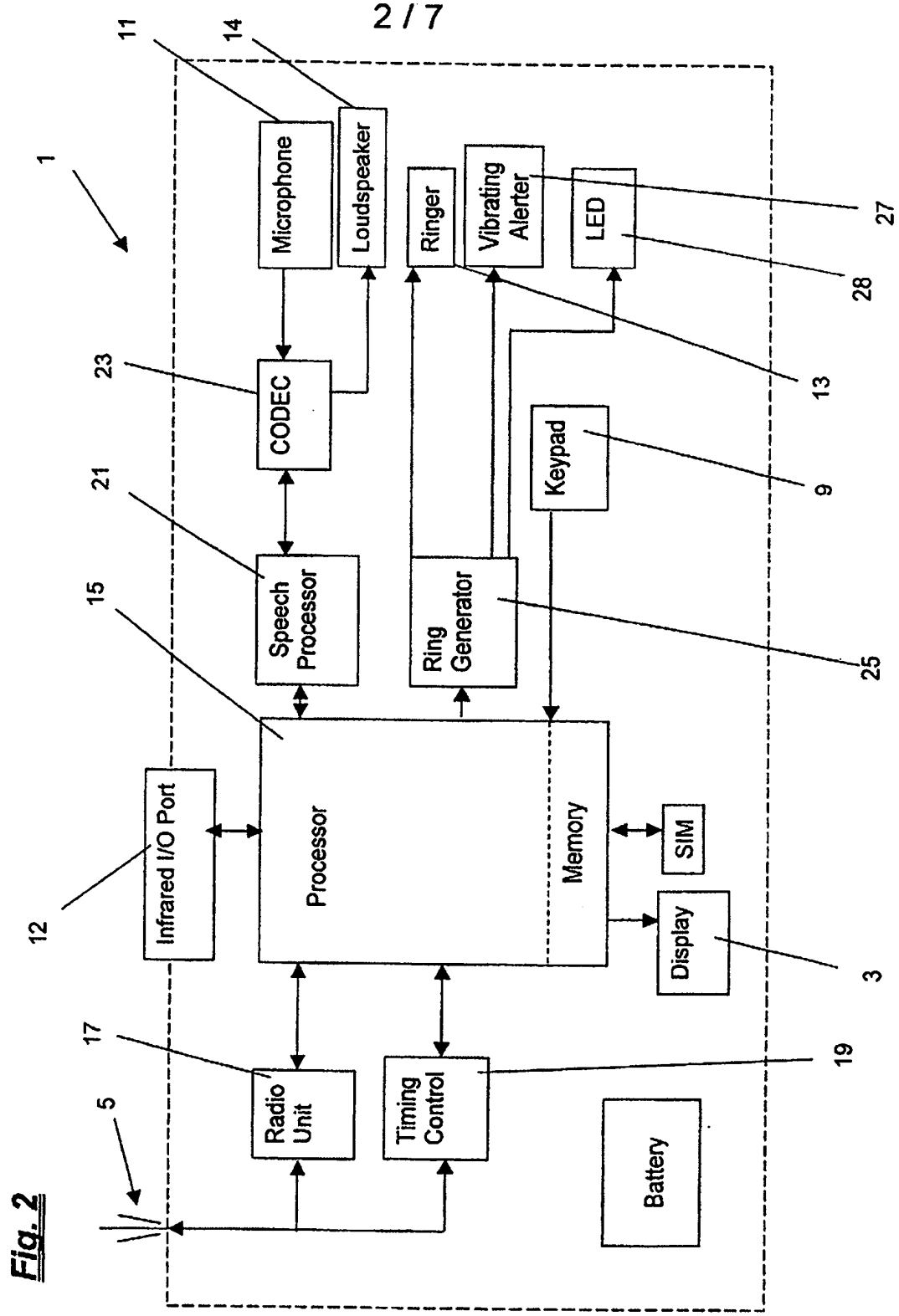

1
11
14
Microphone
Loudspeaker
Ringer
Vibrating Alerter
LED
27
28
13
23
CODEC
21
Speech Processor
Keypad
9
15
Ring Generator
25
Processor
Memory
SIM
Infrared I/O Port
12
Display
3
17
Radio Unit
Timing Control
19
5
Battery

Fig. 2

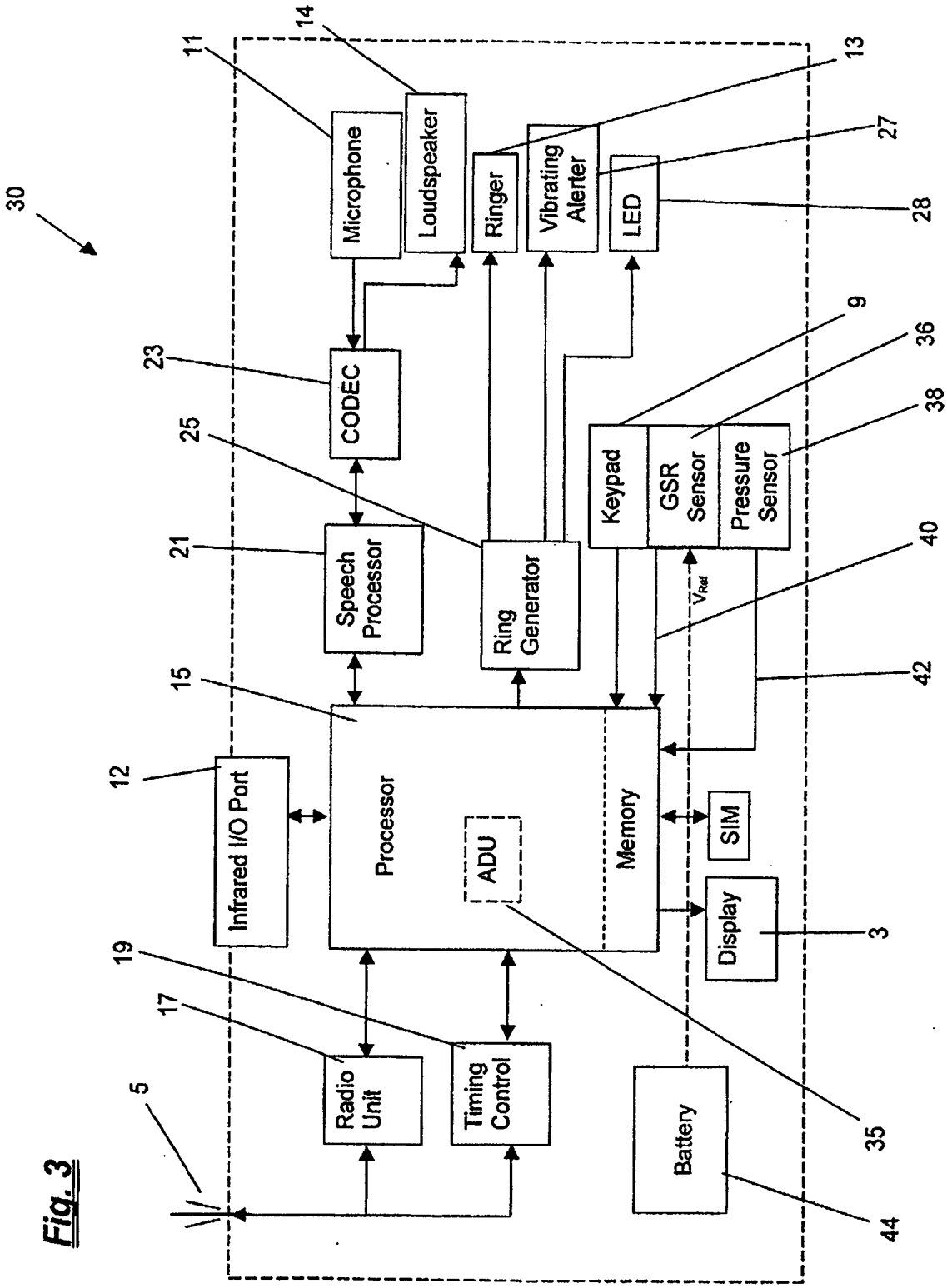

30
11
14
13
27
28
Microphone
Loudspeaker
Ringer
Vibrating Alerter
LED
23
CODEC
25
9
36
38
Keypad
GSR Sensor
Pressure Sensor
21
Speech Processor
Ring Generator
40
V_{Ref}
15
42
12
Infrared I/O Port
Processor
ADU
Memory
SIM
Display
3
19
17
Radio Unit
Timing Control
Battery
5
35
44

Fig. 3

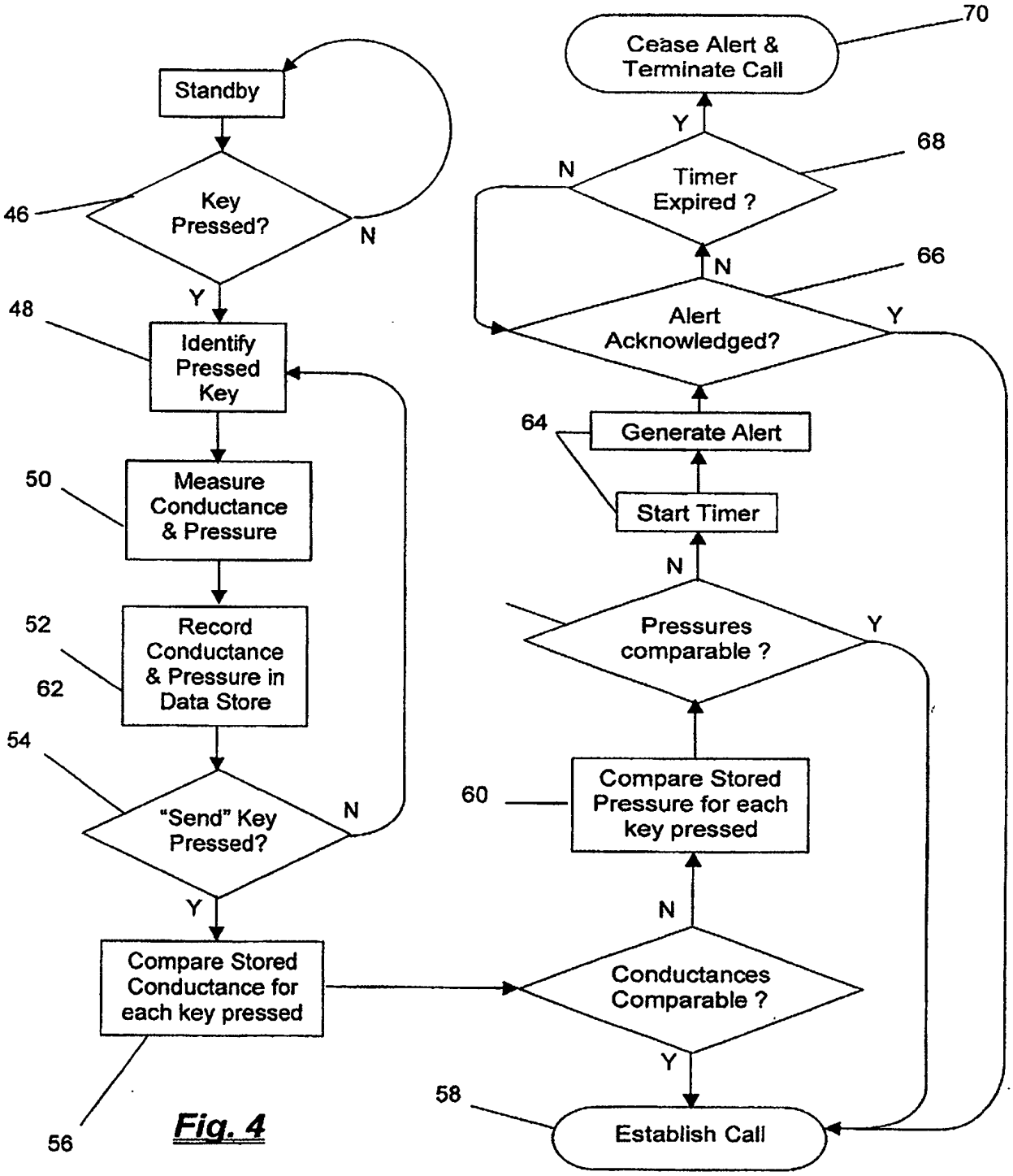

Standby
Key Pressed?
46
N
Y
48
Identify Pressed Key
50
Measure Conductance & Pressure
52
Record Conductance & Pressure in Data Store
62
54
"Send" Key Pressed?
N
Y
Compare Stored Conductance for each key pressed
56
Conductances Comparable ?
Y
58
Establish Call
N
Compare Stored Pressure for each key pressed
60
N
Pressures comparable ?
Y
N
Start Timer
64
Generate Alert
N
Alert Acknowledged?
66
Y
N
Timer Expired ?
68
Y
Cease Alert & Terminate Call
70

Fig. 4

Fig. 5a

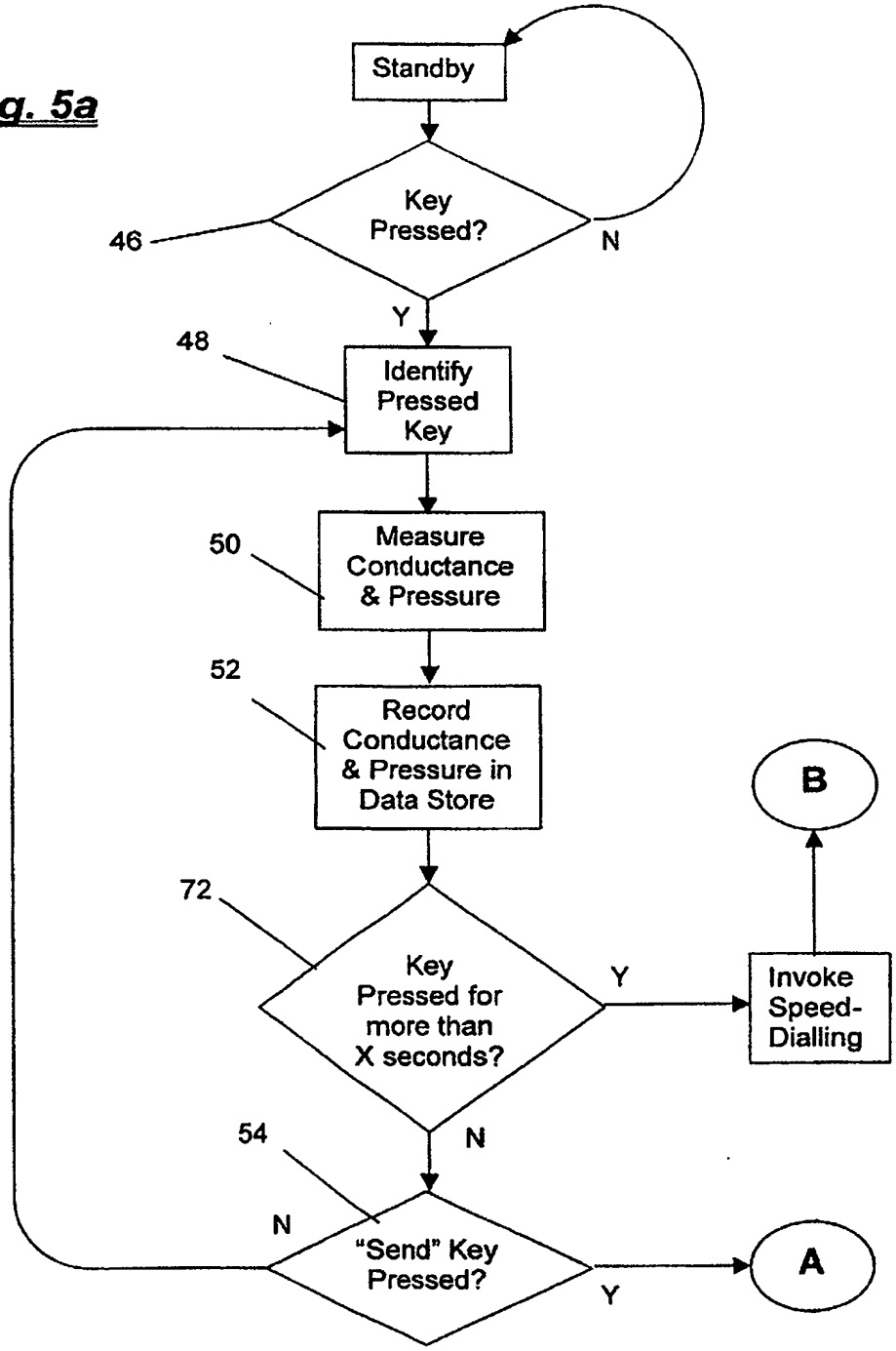

Standby
Key Pressed?
46
N
Y
48
Identify Pressed Key
50
Measure Conductance & Pressure
52
Record Conductance & Pressure in Data Store
72
Key Pressed for more than X seconds?
Y
Invoke Speed-Dialling
B
N
54
N
"Send" Key Pressed?
Y
A

Fig. 5b

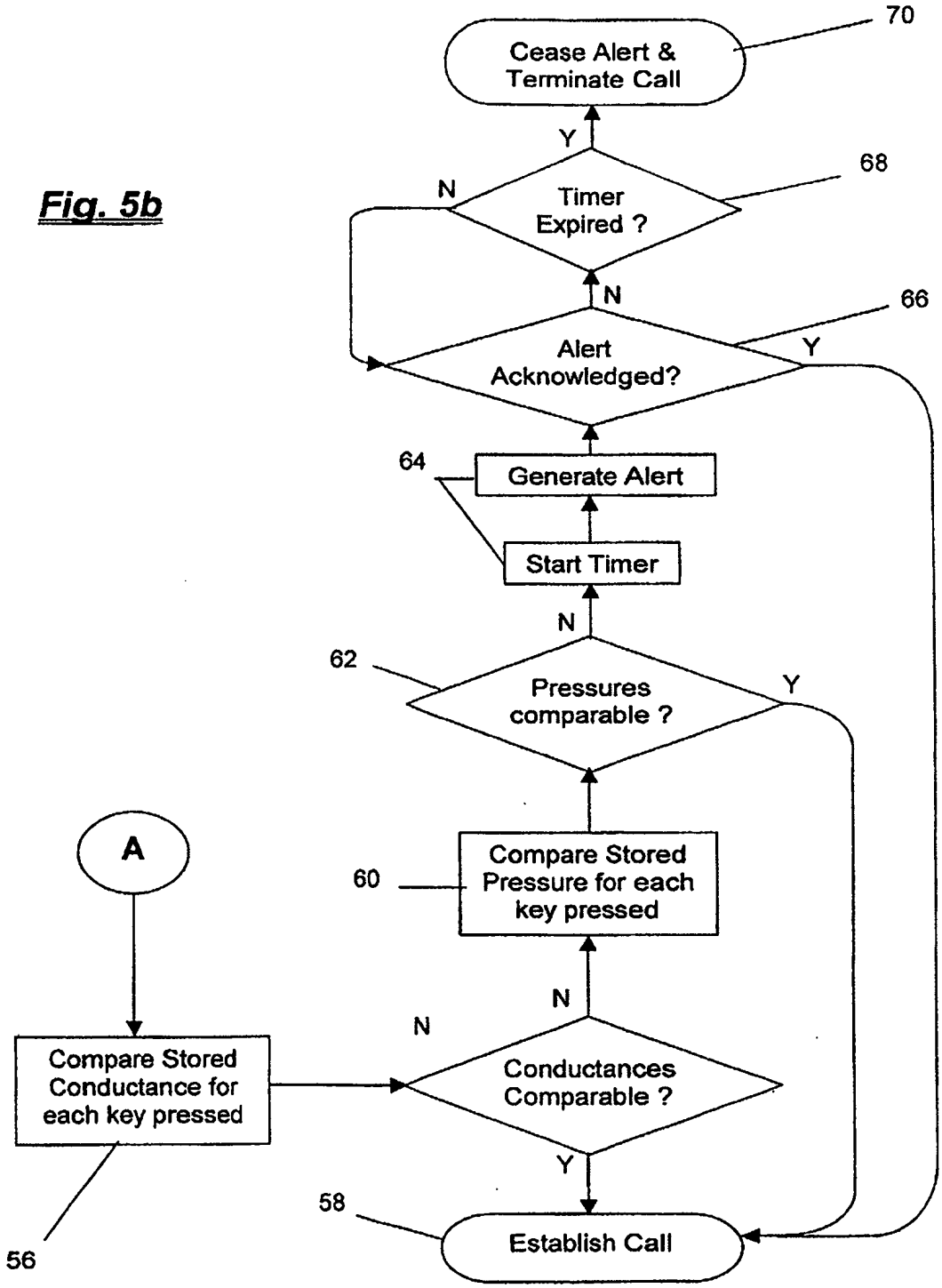
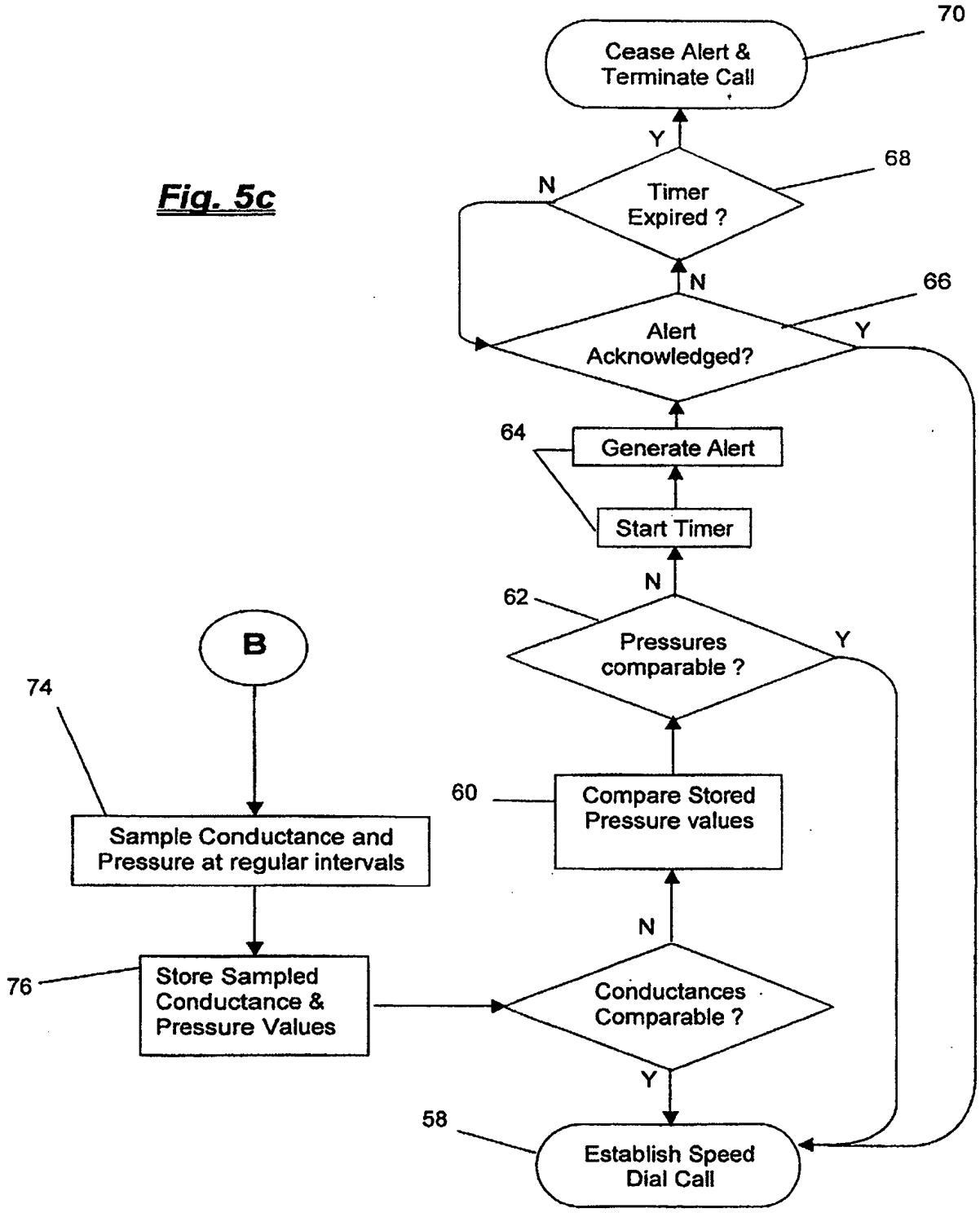

Cease Alert & Terminate Call
70
Y
N
Timer Expired ?
68
N
Alert Acknowledged?
66
Y
64
Generate Alert
Start Timer
N
62
Pressures comparable ?
Y
A
60
Compare Stored Pressure for each key pressed
N
N
Compare Stored Conductance for each key pressed
Conductances Comparable ?
Y
58
Establish Call
56

Fig. 5c


70
Cease Alert & Terminate Call
Y
68
N
Timer Expired ?
N
66
Alert Acknowledged?
Y
64
Generate Alert
Start Timer
N
62
Pressures comparable ?
Y
B
74
60
Compare Stored Pressure values
Sample Conductance and Pressure at regular intervals
N
76
Store Sampled Conductance & Pressure Values
Conductances Comparable ?
Y
58
Establish Speed Dial Call

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COMMUNICATIONS TERMINAL

BACKGROUND TO THE INVENTION

This invention relates to communications terminals, and in one particularly preferred embodiment to mobile communications terminals, such as a mobile telephone for example.

SUMMARY OF THE PRIOR ART

One previously proposed communications terminal, in this case a mobile telephone, is illustrated schematically in Figure 1 of the accompanying drawings.

As shown, the terminal 1 comprises a display 3, an aerial 5 and a plurality of keys 9 arranged in a keypad. The keys, as is known in the art, can be arranged as so-called hard keys with one predetermined function or alternatively they can be arranged as soft-keys which have a plurality of functions depending on the particular operating mode of the terminal. The terminal 1 is provided with a microphone 11 and a loudspeaker 14 for input of user speech and generation of audio signals for relaying to a user. An infra-red input/output port 12 is also provided to permit infrared optical data signals to be received from and/or transmitted to other mobile terminals which are also equipped with an appropriate port.

Figure 2 is a schematic representation of key components of the terminal shown in Figure 1. As shown the terminal 1 includes a central control unit or processor 15 that, at least in general terms, is operable to control operation of the terminal. Coupled to the processor 15 is a radio unit 17 and timing control circuitry 19 that together are operable to control the transmission and reception

of telecommunications signals to and from other telecommunications terminals or from telecommunications networks to which the terminal can connect via the aerial 5.

A removable data storage device or subscriber identity module (SIM) is provided for data and program storage. The data will usually comprise the IMSI (which uniquely identifies the telephone), and other information such as a set of telephone numbers stored on the phone by the user. Software programs may also be stored on the SIM as part of the so-called SIM toolkit (or SIM application toolkit as it is otherwise known).

Coupled to the processor 15 is the display 3, and signals can be sent from the processor 15 to the display in order to convey messages, instructions, and other information to a user of the terminal. The processor is also coupled to the keypad 9 for data input by a user to the terminal.

Sound (for example user speech) picked up by the microphone 11 is processed by a speech processor 21 (for example to remove non-transmittable frequencies), and a coder/decoder (CODEC) 23 that is operable to convert analogue signals generated by the microphone 11 into digital data for subsequent processing. The speech processor 21 and CODEC 23 are also operable to process received digital data and convert it into appropriate audio signals for relaying to a user by means of the loudspeaker 14.

Also coupled to the processor 15 is a ring generator 25 which is operable to generate one of a variety of different alerts which are used to alert a user of the terminal as to when a call, a message or other information is received at the terminal 1. In this particular case the ring generator is operable to generate

appropriate signals to drive a vibrating alerter 27, to illuminate an LED 28 (or bank of illumination devices) or to generate a ring signal for relay to the user via a ringer 13. Typically, a user of the terminal is able to select which of these alert options are most preferable for their current ambient environment. For example, a user who is at work and does not want to disturb his or her colleagues with an audible ring tone might choose the vibrating alerter as an alternative means to alert them to an arriving call at the terminal.

It is a recognised problem with communications terminals in general, and mobile telephones in particular, that it is relatively easy to accidentally place a telephone call to another party (a called party).

To combat this problem, most modern mobile telephones are provided with a "key lock" facility to temporarily disable the keypad of a mobile telephone (and hence prevent the user from placing a call until the keypad has been unlocked).

However, it has recently been reported in an article published in The Guardian (RTM) on Monday 30 July 2001 that despite the provision of such a facility, an estimated 24% of calls received by the emergency services in the United Kingdom (some 2,000 calls a day) were made from mobile telephones where no emergency service had been requested. These so-called "silent calls" were found, in the main, to have been made by mobile telephone owners who had made the call by *accidentally* pressing a key on their telephone.

Typically, these accidental calls tend to have been placed by telephone owners who have forgotten to engage the key lock facility on their phones and who have accidentally pressed one or more buttons on the keypad (by sitting on

the phone, for example). However, in some cases the telephone owners *have* remembered to engage the key lock facility on their phones but the design of the phone is such that the key lock is automatically overridden if a call is placed to the emergency services (by dialling "999", "911" or "112" for example). The problem is compounded yet further by the fact that some phones are programmed to speed-dial the telephone number of the emergency services if a key on the keypad is pressed for more than a few seconds.

To combat this accidental call problem (as reported in the House of Commons Hansard Written Answers for 19 November 2001) the authorities in the United Kingdom have implemented a system whereby silent calls (i.e. those where no emergency service has been requested) are routed through a switch on the network side of the air interface that engages a recorded message. This message states that the emergency services have been called, but that no voice connection has been detected, and that the number "5" on the keypad should be pressed twice if the emergency services are required. If no response is received the call is then automatically terminated.

In the United States of America, Nextel Communications (RTM), Inc. has proposed to reduce the number of accidental emergency calls by offering a software upgrade to its customers that disables a pre-programmed 9-1-1 Emergency Feature which automatically places a call to the emergency services (by dialling 9-1-1) if the "9" key on the keypad is pressed for two seconds.

Another proposal for reducing the impact of these problems (as reported in Cellular News - see: http://www.cellular-news.com) was to introduce a charge for accidental emergency calls in the hope that the prospect of being charged for

making calls would encourage mobile phone owners to engage the keypad locks on their phones, and hence reduce the number of accidental calls.

Another system which could be used to reduce accidental activation of a terminal is described in European Patent Application No. 1109382. In this system a mobile phone is provided with two detectors that are each operable to measure - using different principles such as Galvanic Skin Response (GSR) or capacitive proximity detection (CP) for example - contact between the terminal and the skin of the user. The system employs simple logic to determine, on the basis of a single measurement by each detector, whether skin contact has occurred and to control one or more functions of the terminal on the basis of that determination. In preferred embodiments of this system, control functions may only be implemented if both detectors indicate that skin contact has occurred.

Whilst each of these proposals would probably have a beneficial effect upon the number of accidental calls placed, they would also have significant disadvantages that it would be preferable to avoid if possible. For example, the recorded message solution implemented in the United Kingdom could result in the termination of emergency calls that have been placed by individuals who have managed to call for help, but are not able to respond to the recorded message (for example because they have lapsed into unconsciousness). Similarly, the software upgrade proposed by Nextel would reduce the number of accidental speed-dialled emergency calls, but at the cost of permanently removing the emergency speed-dial feature from the phone; and the proposal to charge for accidental emergency calls is likely to unfairly prejudice those persons who have a phone that permits calls to be placed to the emergency

services even though the key lock has been engaged.

The system proposed in European Application No. 1109382 could probably be adapted to help reduce the number of unwanted calls, but such an adaptation would be susceptible to an incorrect determination of skin contact and hence to incorrectly allowing accidental calls to proceed. For example, if the terminal of this system were to be carried in a damp trouser pocket then the dampness of the phone's immediate surroundings could fool a GSR detector into indicating that skin contact has occurred. Similarly, if the terminal were to come into contact with water (as might happen if it is used in the rain) and were then to be placed in a handbag, an accidental depression of keys on the terminal (by contact with other items carried in the handbag for example) could be determined to be valid as a result of conductive pathways formed by water lying on the surface of the phone. Clearly, when each false emergency call has the potential to prevent the emergency services from dealing with a real emergency, any mechanism to automatically avoid accidental calls should be robust and capable of preventing accidental calls in the majority of cases.

The system proposed in this European Application may also prove inconvenient for users if implemented as a GSR detector and another detector which must both indicate skin contact before functions of the phone can proceed. If such a system were to be provided then users would always have to touch the phone with bare flesh to get it to function – and in winter this could well require gloves or the like to be removed before the phone can be used.

Yet another disadvantage with the system proposed in this European Application is that the GSR sensor disclosed requires a threshold to be set

against which the conductivity of the user is measured. This arrangement is highly disadvantageous given that the conductivity of the skin of a user can vary significantly in dependence upon factors such as the ambient environmental conditions, the user's emotional state or aspects of the user's physical state. Clearly, with the possibility of significant conductivity variations the threshold must either be set low enough to accommodate all possible variations (in which case the risk of an incorrect determination is increased), or maintained at a level where the risk of an incorrect determination is acceptable (in which case there is a chance that a given user's conductivity may not be sufficient to trigger a determination of skin contact). In either event the system proposed would be prone to problems.

It is apparent, therefore, that whilst a number of different "solutions" have previously been proposed to the problem of accidental calls, there is still a need for a terminal that is free from the disadvantages attendant upon prior art proposals, and it is a particular aim of the present invention to provide just such a terminal.

STATEMENT OF INVENTION

In pursuit of this aim, one embodiment of the present invention provides a communications terminal comprising: a plurality of keys for input to the terminal, means for generating a plurality of measurements of different characteristics of one or more interactions with one or more of said keys; means for comparing the plurality of measurements for at least a first of said characteristics; and means for controlling the establishment of a call on the basis of the results of said comparison.

This embodiment of the invention implements the observation that interactions performed by a human user tend to have consistent characteristics, whereas interactions performed by accident tend to have varying characteristics. The invention makes use of this observation to improve the detection and automatic termination of accidental calls.

Another aspect of the invention relates to a method of controlling the establishment of a call from a communications terminal, the method comprising the steps of: generating a plurality of measurements of different characteristics of one or more interactions with one or more keys of said terminal; comparing the plurality of measurements for at least a first of said characteristics; and controlling the establishment of a call on the basis of the results of said comparison. Yet another aspect of the invention relates to a computer program for implementing one or more of the steps of this method, and to storage means (like a SIM card or other storage device, for example) for storing the computer program.

Preferred features of these embodiments are set out in the description and in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will now be described in detail, by way of illustrative example only, with reference to the accompanying drawings, in which:

Fig. 1 is a schematic representation of a previously proposed communications terminal, in this case a mobile telephone;

Fig. 2 is a schematic representation of components of the terminal of Fig. 1;

Fig. 3 is a schematic representation of components of a communications terminal, in this case a mobile telephone, in accordance with a first embodiment of the invention;

Fig. 4 is a flow chart illustrating the operating procedure of a terminal in accordance with the first embodiment of the invention; and

Figs 5a, 5b and 5c are flow charts illustrating the operating procedure of a terminal in accordance with a second embodiment of the invention that comprises a modification of the first embodiment shown in Fig. 4.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Various embodiments of the invention will now be described in detail with reference to a mobile telephone of the kind shown in Fig. 1 of the accompanying drawings, and with particular reference to the use of that terminal for the avoidance of accidental emergency calls. However, it will be appreciated – and should be noted – that the teachings of the present invention are equally applicable to any communications terminal (such as a mobile telephone, a landline telephone (i.e. for direct wired connection to the PSTN), a portable digital assistant (PDA) with telephonic capabilities, or any other sort of telephonic transceiver equipment). It should also be noted that whilst the teachings of the invention have particular utility in the avoidance of accidental calls to the emergency services, it will be apparent that they are equally applicable to non-emergency calls. As a consequence, the following description should not be read as limiting the scope of the present invention in any way.

As mentioned above, Fig. 3 is a schematic representation of the components of a communications terminal in accordance with a first

embodiment of the invention.

In the particular example shown in Fig 3, the communications terminal is embodied as a mobile telephone such as a GSM or UMTS compatible telephone. The majority of the components of the telephone 30 are the same as those illustrated in Fig. 2, and these components will be referenced with the same numerals as those used above in connection with the description of Fig. 2. The telephone of this embodiment is configured as the simplest implementation of the invention for use in circumstances where speed-dialling is not available or is not required. An alternative embodiment where speed-dialling is available will later be described.

As shown the phone 30 comprises a display 3, an aerial 5 and a plurality of keys 9 arranged in a keypad, a microphone 11 and a loudspeaker 14 for input of user speech and generation of audio signals for relaying to a user. An infra-red input/output port 12 is provided to permit the reception and/or transmission of infrared optical data signals[1].

The terminal 30 includes a central control unit or processor 15, and coupled to the processor 15 is a radio unit 17 and timing control circuitry 19 that are operable to control the transmission and reception of telecommunications signals. The display 3 is also coupled to the processor 15, and signals can be sent from the processor 15 to the display in order to convey messages, instructions, and other information to a user of the terminal.

The processor is also coupled to the keypad 9 (for data input by a user to

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[1] other low power radio communications devices (e.g. Bluetooth (TM)) can be provided in place of, or in addition to an IR input/output port.

the terminal), and to a ring generator 25 which is operable to generate one of a variety of different alerts which are used to alert a user of the terminal as to when a call, a message or other information is received at the terminal. In this particular case the ring generator is operable to generate appropriate signals to drive a vibrating alerter 27, an LED or equivalent illumination device 28 or to generate a ring signal for relay to the user via the ringer 13.

A microphone 11 is provided, and is operable to convert sound signals (such as user speech for example) from the phone's ambient environment into analogue AC electrical signals that are subsequently passed to a speech processor 21 for processing (for example to remove non-transmittable frequencies), and a coder/decoder (CODEC) 23 that is operable to convert the analogue signals generated by the microphone 11 into digital data for subsequent processing. The speech processor 21 and CODEC 23 are also operable to process received digital data and convert it into appropriate analogue audio signals for relaying to a user by means of the loudspeaker 14.

The processor 15 comprises an automatic disconnect unit (ADU) 35. In the preferred embodiment, the ADU is implemented by software executed by the processor 15. It will be appreciated, however, that the functionality of the ADU could of course be provided by hardware (such as one or more application specific integrated circuits (ASICs) for example) wired to the processor 15. The ADU, in software form, could form part of a so-called SIM Toolkit (or SIM Application toolkit as it is sometimes known) or part of the software provided in the mobile terminal.

Each key of the keypad 9 is provided, in the preferred embodiment, with

a galvanic skin response sensor 36 as a first sensor, and a pressure sensor 38 as a second sensor. These sensors may be implemented as discrete hardware units (as shown) coupled to the processor 15, or alternatively they may be implemented as software modules executable by the processor 15.

Each galvanic skin response (GSR) sensor 36 comprises a first terminal 40 connected to the processor 15, and a second terminal 42 connected to a reference voltage 44 that in the preferred embodiment is provided by a battery of the terminal. When a user touches a given GSR sensor, the user's skin makes an electrical contact between the two terminals and current flows between them. This current can be measured to provide an indication of the conductance of the user's skin.

As will later be described, an advantage of the present invention over the system proposed in European Patent Application No. 1109382 is that the measurement of conductance is comparative, and this means that the GSR sensors of the preferred embodiment do not require a conductance threshold and thus that the sensors of the preferred embodiment are not subject to the problems faced by the system proposed in European Patent Application No. 1109382 where conductance is measured relative to a predetermined threshold conductance.

Each pressure sensor 38 is operable to generate signals that are indicative of the pressure applied thereto as a given button is pressed. The sensors themselves are conventional in the art, and thus will not be described in any great detail here. One example of a sensor that might prove useful for this purpose is described in the paper written by Patrik Melvås, Jessica Melin, Edvard Kälvesten

and Göran Stemme entitled "Ultra-miniaturized Pressure Sensor for Intravascular Blood Pressure Measurements"[2].

As will later be described in detail, the galvanic skin response and pressure is measured for each key depression, and data values for these measurements are stored in a data store. Once the particular sequence of keys for a given number to be dialled has been pressed, the ADU 35 compares the stored GSR readings with one another to determine (a) whether the stored GSR measurements are non-zero, and (b) whether the stored GSR measurements are generally comparable with one another (to within a predetermined tolerance). If the stored GSR measurements are non-zero and roughly comparable to one another, then the key depression(s) are deemed to have been intentional and the call is allowed to proceed.

If, on the other hand, the stored GSR measurements are zero or substantially different to one another (i.e. outside of the aforementioned predetermined tolerance), the ADU 35 retrieves the stored pressure measurements for the keys, and compares them with one another. If the pressure measurements are determined to be generally comparable, the pressing of keys is deemed to have been intentional and the call is allowed to proceed.

If the stored pressure measurements are determined to be significantly different from one another, then the pressing of keys is deemed to have been accidental and an alert is generated to notify the user that a call has been placed. If the alert is subsequently acknowledged, the call is allowed to proceed. If the alert is not acknowledged by the user then the call is automatically terminated.

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[2] See http://www.s3.kth.se/mst/research/projects/pressure.html for further details.

The user could be alerted to the placing of a call by operating the vibrating alerter 27, the LED or equivalent illumination device 28, by operating the ringer 13, or by replaying a recorded message to the user via the loudspeaker 14. Acknowledgment of the alert could be accomplished by pressing a key, or simply by speaking into the terminal so that the user's voice can be detected, for example by a voice activity detection (VAD) algorithm. Further details of VAD algorithms are explained in GSM recommendation: GSM 06.82 "Voice Activity Detection (VAD) for Enhanced Full Rate (EFR) speech channels", and are not further discussed here.

By virtue of this process it is possible to robustly and reliably detect whether the keys have come into contact with the user's skin. Furthermore, where it is not possible to detect skin contact, the process described above nevertheless makes it possible to reliably determine the nature of a given call by measuring the pressure applied to each key. In such circumstances, human users tend to use roughly the same amount of pressure when pressing keys on a mobile terminal. Accidental key depressions (as might happen if the terminal is carried in a handbag for example) on the other hand are typically much less predictable, and in the vast majority of cases have values for applied pressure which differ between key presses, and thus will probably not be within the aforementioned tolerances.

The process described above in general terms will now be described in detail with reference to Fig. 4 of the accompanying drawings.

Figure 4 is a flow chart illustrating schematically the steps described above. As shown, when the terminal detects in step 46 that a key has been

pressed, the ADU 35 notes the identity of the pressed key (in step 48) and activates the GSR sensor 36 and the pressure sensor 38 for each of the keys of the keypad 9. The ADU then measures (in step 50) the current flowing between the terminals (if any) of the GSR sensor and the pressure applied to the key to depress it. The measured pressure and GSR (i.e. current) for the key are then stored in a data store in step 52.

In the next step of the process (step 54) the ADU 35 determines whether the "send" key has been pressed (to initiate communications once all the digits of a given phone number have been entered into the phone). If the "send" key has not been pressed, the ADU concludes that the entire phone number has not yet been entered into the phone and returns to step 48 to await pressing of the next key in the sequence of numbers making up the phone number to be dialled.

If the "send" key has been pressed, the ADU retrieves (in step 56) the stored GSR values, and compares those values with one another to determine whether the variation between individual measurements is within a predetermined tolerance (say 5, 10 or 15 percent for example). If the variation between conductances is within the tolerance, then the call is allowed to proceed (step 58). If, on the other hand, the variation between conductances is outside of the tolerance, then the next step – step 60 – is to compare the stored pressure values for the pressed keys with one another. If the variation between stored pressure values is determined (in step 62) to be less than or equal to the tolerance, then the call is allowed to proceed in step 58.

If the variation between pressure values is determined to be outside of the tolerance, then the next step (step 64) is to start a timer and alert the user to the

fact that a call has been placed (the alert being accomplished by any of the different means mentioned above). The user is then prompted, in step 66, to confirm that the call was intentional, and the call is allowed to proceed if that confirmation is provided.

If no confirmation from the user is forthcoming before the timer expires in step 68, then the ADU 35 assumes that the call is accidental and immediately takes steps to terminate the call.

It can be seen from the above, that this embodiment of the invention provides an effective means of automatically terminating calls in the event that the terminal is unable to detect a consistent skin contact or applied pressure. This can occur, for example, when the user accidentally places a call.

As a modification of this arrangement, the "send" key may also be provided with GSR and pressure sensors (for example), and measurements taken when it is pressed may be added to those already stored in respect of other key presses.

As mentioned above, Figs 5a, 5b and 5c are flow charts illustrating the operating procedure of a terminal in accordance with a second embodiment of the invention that comprises a modification of the first embodiment shown in Fig. 4.

It may be remembered from the above, that the arrangement of Figs 3 and 4 was configured as the simplest implementation of the invention for use in circumstances where speed-dialling is not available or is not required. The process illustrated in Fig 5 provides an embodiment where speed-dialled calls from mobile phones can be considered to determine whether or not the call is

accidental or intentional before allowing it to proceed. Speed dialled calls from mobile phones, as is well known in the art, are those where a single key is pressed and held down for a predetermined period of time (typically a few seconds) to cause a phone to automatically go off hook and dial a pre-stored phone number.

As the process of Fig 5 is a modification of that shown in Fig 4, a number of steps of the process are common to the process of Fig 4, and those common steps will be indicated by means of the same reference numerals used in Fig 4 and will not be described again in detail.

Looking now at Fig 5a, the chief difference between this embodiment and the first embodiment is that the process of this embodiment is capable of making a determination of whether a speed dial request has been placed intentionally.

To implement this functionality, the process of Fig 4 is modified to include a further step 72 (see Fig 5a) which determines whether a given key has been pressed for longer than a predetermined threshold period of time "X". For example, if a key on the keypad has to be pressed for three seconds to implement a speed-dial function, then the threshold could be set to two seconds. In such a situation, key presses of less than two seconds would be treated as a normal key press (and dealt with in accordance with the process of Fig 4), whereas key presses of more than two seconds would be treated as a request for a speed-dial.

Once a speed dial request has been made, the next step in this modified process (step 74 – see Fig. 5c) is to "sample" the conductance and applied pressure at regular intervals. By this we mean that in this next step the conductance and pressure is measured at regular intervals to acquire a number of

different measurements that are stored in the data store in step 76. These different measurements can subsequently be compared to one another in the following steps (steps 58 to 70) of the process.

In the particular example mentioned above where the threshold is set to two seconds, a pressure and GSR measurement could be taken every quarter of a second after the two-second threshold to give four sets of measurements than can subsequently be compared to determine whether or not a call is intentional before allowing it to proceed. A variety of alternative arrangements are possible.

As mentioned before, accidental speed-dial calls are likely to exhibit fluctuations of applied pressure, whereas intentional speed-dial calls are likely to exhibit a generally constant applied pressure, and as a consequence it is possible to differentiate between accidental and intentional calls by measuring, for example, the applied pressure.

It can be seen from the above, that the adaptation of a conventional mobile terminal to include an ADU having the functionality described above, provides an effective means to reduce the impact of accidental calls from mobile terminals. As mentioned before the ADU preferably comprises software which is executable by the processor, and which resides in memory or other storage device[3] of the terminal, as part of the aforementioned SIM Toolkit, or elsewhere. The software could even be downloaded from a remote store for local execution. As an alternative, it would be possible for the ADU to be implemented as hardware such as, for example, one or more ASICs.

[3] such as a WIM, USIM, Memory Stick, MMC card, Flash card, internal Flash, static or dynamic RAM, pseudo static RAM or a miniature hard disk, for example.

In the embodiments described above, the comparison of stored measurements for different characteristics (such as conductance and/or pressure values, for example) of interactions with the terminal can be accomplished by any of a number of different mathematical processes.

One illustrative mathematical process comprises subtracting the lowest measurement from the highest measurement and then comparing the difference between these two values (i.e. the range) to a predetermined value, the measurements for a given characteristic being determined to be similar to one another if the range is less than the predetermined value. In alternative arrangements, the mathematical mean or standard deviation of the values could be calculated and compared to a predetermined value, the measurements being determined to be similar if they are within a predetermined range of the predetermined value. A variety of different mathematical possibilities for comparison of the values will be apparent to persons skilled in the art, and the scope of the invention should be construed to include all of these possibilities.

In addition, it will be understood that modifications and alterations may be made to the preferred embodiments described above without departing from the scope of the invention.

For example, whilst the description concentrates primarily on mobile telephones that are compatible with the GSM telecommunications standards, it will be appreciated that the teachings of the invention are equally applicable to non-GSM compliant mobile telephones[4], landline telephone transceiver equipment or to any other item of telecommunications equipment.

It should also be noted that other types of sensors may be used in place of the galvanic skin sensor and the pressure sensor described herein. For example, one of the sensors could be a capacitive proximity detector (such as those manufactured by TURCK Inc., of 3000 Campus Drive, Minneapolis, MN 55441, United States of America).

It will also be apparent, and again should be noted, that features of the embodiments described herein are applicable to any of the various embodiments of the invention, and thus that the scope of the invention extends to combinations of features described herein irrespective of whether those particular combinations are explicitly enumerated in the claims.

[4] Such as GPRS, UMTS, W-CDMA, CDMA2000, IS95, TDMA, IEE802.11(x), Hyperlan etc.

CLAIMS

1. A communications terminal comprising: a plurality of keys for input to the terminal, means for generating a plurality of measurements of different characteristics of one or more interactions with one or more of said keys; means for comparing the plurality of measurements for at least a first of said characteristics; and means for controlling the establishment of a call on the basis of the results of said comparison.

2. A terminal according to Claim 1, wherein said control means is operable to allow the establishment of said call if said plurality of measurements for said first characteristic are determined to be similar to one another.

3. A terminal according to Claim 2, wherein said plurality of measurements for said first characteristic are determined to be similar to one another if a difference between a highest and a lowest of said plurality of measurements for said first characteristic is less than a predetermined value.

4. A terminal according to Claim 2, wherein said plurality of measurements for said first characteristic are determined to be similar to one another if the mean or standard deviation of said plurality of measurements for said first characteristic is within a predetermined range of a predetermined value.

5. A terminal according to any preceding claim, wherein said control means

is operable to control the comparing means to compare the plurality of measurements for a second of said characteristics if said plurality of measurements for said first characteristic are determined to be dissimilar to one another.

6. A terminal according to Claim 5, wherein said plurality of measurements for said first characteristic are determined to be dissimilar to one another if a difference between a highest and a lowest of said plurality of measurements for said first characteristic is greater than a predetermined value.

7. A terminal according to Claim 5, wherein said plurality of measurements for said first characteristic are determined to be dissimilar to one another if the mean or standard deviation of said plurality of measurements for said first characteristic is outside of a predetermined range of a predetermined value.

8. A terminal according to Claim 5, 6, or 7, wherein said control means is operable to allow the establishment of said call if said plurality of measurements for said second characteristic are determined to be similar to one another.

9. A terminal according to Claim 8, wherein said plurality of measurements for said second characteristic are determined to be similar to one another if a difference between a highest and a lowest of said plurality of measurements for said second characteristic is less than a predetermined value.

10. A terminal according to Claim 8, wherein said plurality of measurements for said second characteristic are determined to be similar to one another if a mean or standard deviation of said plurality of measurements for said second characteristic is within a predetermined range of a predetermined value.

11. A terminal according to any of Claims 5 to 10, comprising means for generating an alert, and wherein the control means is operable to control said alert generator to generate an alert if said plurality of measurements for said second characteristic are determined to be dissimilar to one another.

12. A terminal according to Claim 11, wherein said plurality of measurements for said second characteristic are determined to be dissimilar to one another if a difference between a highest and a lowest of said plurality of measurements for said second characteristic is greater than a predetermined value.

13. A terminal according to Claim 11, wherein said plurality of measurements for said second characteristic are determined to be dissimilar to one another if a mean or standard deviation of said plurality of measurements for said second characteristic is outside of a predetermined range of a predetermined value.

14. A terminal according to any of Claims 11 to 13, wherein said control means is operable to prevent the establishment of said call if said alert is not

acknowledged within a predetermined period of time.

15. A terminal according to any preceding claim, wherein said plurality of measurements are taken from a single interaction with a single key, and are spaced from one another in time.

16. A terminal according to any preceding claim, wherein said plurality of measurements are taken from interactions with a plurality of keys, one measurement being taken for each interaction.

17. A terminal according to any preceding claim, comprising means for storing said plurality of measurements for each of said characteristics;

18. A terminal according to any preceding claim, wherein said means for generating measurements for a first of said characteristics comprises means for measuring a galvanic skin response.

19. A terminal according to any of claims 1 to 17, wherein said means for generating measurements for a first of said characteristics comprises a capacitive proximity detector.

20. A terminal according to claim 18 or 19, wherein said means for generating measurements for a second of said characteristics comprises a pressure sensor.

21. A terminal according to claims 18 and 20, wherein each key of said keypad is provided with means for measuring a galvanic skin response and a pressure sensor for generating measurements of first and second characteristics respectively.

22. A terminal according to claims 19 and 20, wherein each key of said keypad is provided with capacitive proximity detector and a pressure sensor for generating measurements of first and second characteristics respectively.

23. A terminal according to any preceding claim configured as a GSM compliant mobile telephone.

24. A method of controlling the establishment of a call from a communications terminal, the method comprising the steps of: generating a plurality of measurements of different characteristics of one or more interactions with one or more keys of said terminal; comparing the plurality of measurements for at least a first of said characteristics; and controlling the establishment of a call on the basis of the results of said comparison.

25. A method according to Claim 24, wherein establishment of said call is allowed if said plurality of measurements for said first characteristic are determined to be similar to one another.

26. A method according to Claim 24 or 25, comprising the further step of: controlling the comparing means to compare the plurality of measurements for a second of said characteristics if said plurality of measurements for said first characteristic are determined to be dissimilar to one another.

27. A method according to any of Claims 24 to 26, wherein establishment of said call is allowed if said plurality of measurements for said second characteristic are determined to be similar to one another.

28. A method according to any of Claims 24 to 27, comprising the additional step of: controlling an alert generator to generate an alert if said plurality of measurements for said second characteristic are determined to be dissimilar to one another.

29. A method according to Claim 27 or 28, wherein establishment of said call is prevented if said alert is not acknowledged within a predetermined period of time.

30. A method according to any of claims 24 to 29, wherein said plurality of measurements are taken from a single interaction with a single key, and are spaced from one another in time.

31. A method according to any of claims 24 to 29, wherein said plurality of measurements are taken from interactions with a plurality of keys, one

measurement being taken for each interaction.

32. A computer program comprising one or more program portions that, when executed in an execution environment, are operable to implement one or more of the method steps of any of Claims 24 to 31.

33. Storage means, such as a SIM card or other storage device, having a computer program according to Claim 32 stored thereon.

34. A terminal substantially as hereinbefore described with reference to the accompanying drawings

35. A method substantially as hereinbefore described with reference to the drawings.

36. A computer program substantially as hereinbefore described with reference to the accompanying drawings.

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Claims searched:	1-36	**Date of search:**	8 August 2002

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): G1N NDTR, NDPX, G4A AKS, H4K KF42, KBNX, H4L LDPD, LDPPX, LEUF, LEUM, LRCMX

Int Cl (Ed.7): G06F 3/02, 3/023, H03K 17/96, H04B 1/38, 17/00, H04M 1/02, 1/03, 1/19, 1/66, 1/725, 3/42, H04Q 1/02, 7/32, 7/34, 7/38

Other: Online: WPI, EPODOC, PAJ, INSPEC and selected internet sites

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2357400 A	Nokia Mobile Phones, See whole document	-
A	JP 2001230849	Matsushita Electric, See supplied PAJ abstract	1, 16, 23, 24, 31-33

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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